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## Herwig++ 2.0 $\beta$ Release Note

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### Abstract

A new release of the Monte Carlo program Herwig++ (version 2.0 $\beta$ ) is now available. The main new feature is the extension of the program to include simple hadron-hadron processes including the initial-state parton shower.

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## 1 Introduction

The last major public version (1.0) of Herwig++ was reported in detail in [1]. In this note we describe the main modifications and new features included in the latest public version, 2.0 $\beta$ .

Please refer to [1] and to the present paper if using version 2.0 $\beta$  of the program.

### 1.1 Availability

The new program, together with other useful files and information, can be obtained from the following web site:

<http://hepforge.cedar.ac.uk/herwig/>

## 2 Hadron-Hadron Collisions

The main new feature of this version is the extension of the original  $e^+e^-$  program to hadron-hadron collisions. In the current version only simple Drell-Yan processes (both  $W$  and  $Z$  production) are supported together with the initial-state shower from the incoming partons, using the algorithm described in [2]. The outgoing partons radiated from the incoming lines are not currently showered, there is no model of the underlying event or matrix element correction for Drell-Yan processes. However, this version does produce hadron-hadron events which can be used to test the integration of the program into experimental simulations and gives an improved  $p_T$  spectrum of the gauge bosons with respect to the FORTRAN HERWIG 6.5 without matrix element corrections. The  $p_T$  distributions of  $Z$  and  $W$  bosons, at the Tevatron and LHC, are compared to HERWIG6.5 in Figs 1 and 2 respectively.

## 3 Other Changes

- A number of changes to the decays and hadronization have been made to improve the stability of the code. As a result of these changes the default strange quark weight `PwtSquark` has been returned to its natural value of 1.0, which increases the amount of K mesons produced and improves the agreement with LEP data.
- The documentation has been changed to use DOXYGEN and is available either via the Herwig++ web-page or with the code. In addition information on using the program has been added to the Herwig++ wiki.
- The build procedure has been significantly improved and now uses the GNU autotools.

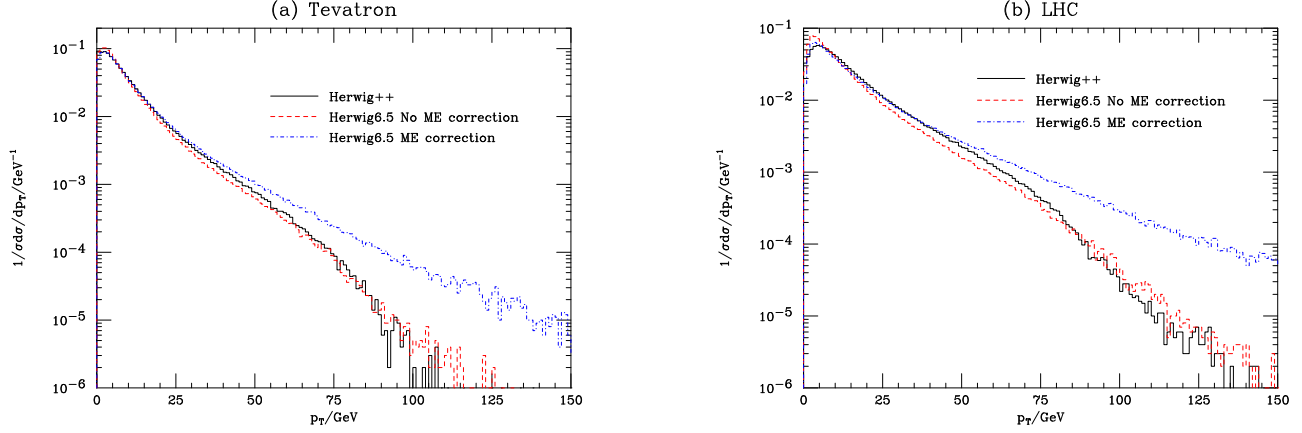


Figure 1: The  $p_T$  spectrum of  $\gamma^*/Z$  bosons produced at (a) the Tevatron and (b) the LHC using Herwig++2.0 $\beta$  compared with HERWIG6.5 with and without matrix element correction. In both cases the mass of the Drell-Yan pair was required to be greater than 20 GeV.

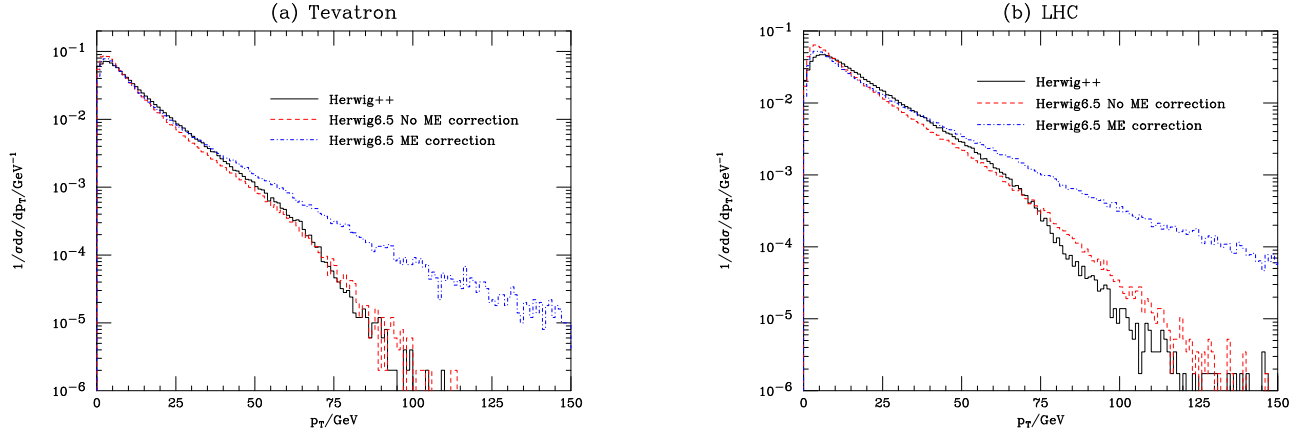


Figure 2: The  $p_T$  spectrum of  $W$  bosons produced at (a) the Tevatron and (b) the LHC using Herwig++2.0 $\beta$  compared with HERWIG6.5 with and without matrix element correction.

- A large library of helicity classes has been included to make implementing additional matrix elements much simpler.
- Many models for hadronic decays have been added which are currently not used by default but can be switched on if needed (see the web-site for how to do this).

## References

- [1] S. Gieseke, A. Ribon, M. H. Seymour, P. Stephens and B. Webber, JHEP **0402** (2004) 005 [arXiv:hep-ph/0311208].
- [2] S. Gieseke, P. Stephens and B. Webber, JHEP **0312** (2003) 045 [arXiv:hep-ph/0310083].
- [3] **HERWIG 6.5**, G. Corcella, I.G. Knowles, G. Marchesini, S. Moretti, K. Odagiri, P. Richardson, M.H. Seymour and B.R. Webber, JHEP **0101** (2001) 010 [arXiv:hep-ph/0011363]; [arXiv:hep-ph/0210213].